

A Radio Frequency Neutron Spin Rotator for the NPDGamma Experiment at LANSCE

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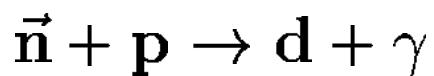
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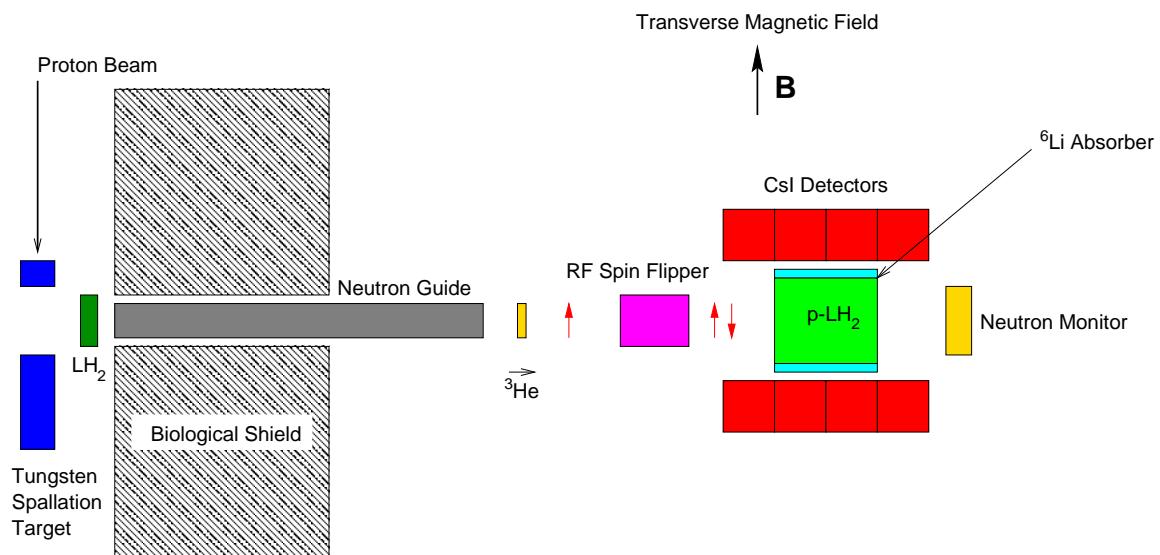
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The NPDGamma Experiment



GOAL: To measure $A_\gamma = \left(\frac{1}{P_n}\right) \left(\frac{N_u - N_d}{N_u + N_d}\right)$



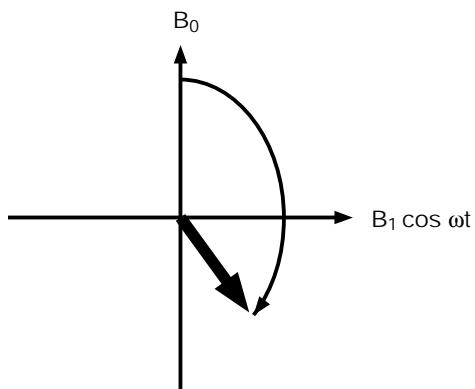
The Radio Frequency Spin Flipper for the NPDGamma Experiment

Requirement:

- Flip the spin of an arbitrary pulse of neutrons

Concept:

- In the presence of a DC magnetic field, apply a resonant RF magnetic field for a period of time suitable to allow the neutron spin to precess by π

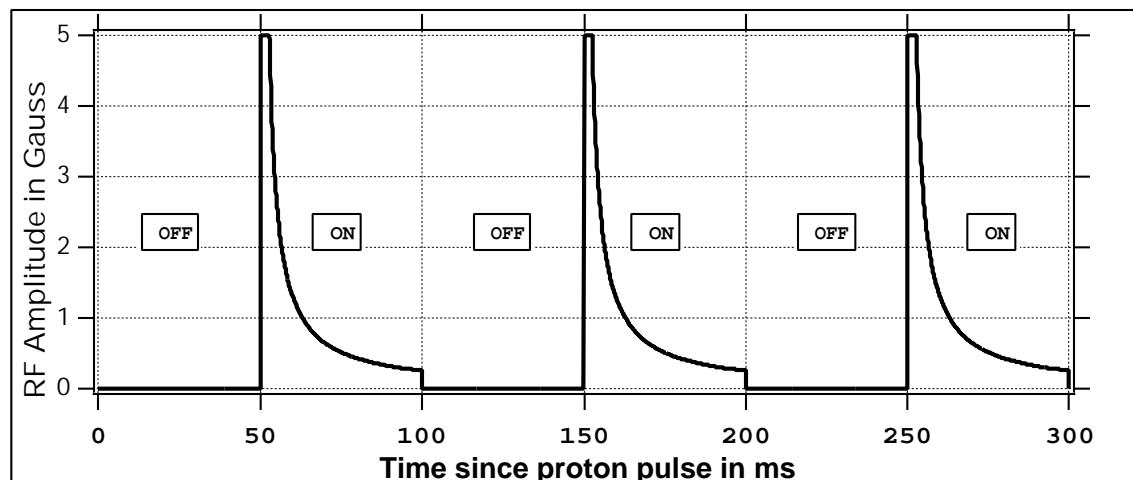


$$B_1 = \frac{D}{\gamma Lt}$$

where D is the distance from the neutron spallation source, γ is the neutron's gyromagnetic ratio, and L is the length of the spin flipper

RF Magnetic Field Amplitude vs Time

Neutron Energy Range: 1-100 meV
RF Magnetic Field Amplitude: 0.3-3.0 G



Advantages:

- Magnetic guide field remains constant
 - No Stern-Gerlach steering
- RF field can be easily shielded

The Radio Frequency Spin Flipper for the NPDGamma Experiment



Solenoid

- 30kHz
- 12 inches in diameter, 12 inches in length
- Inductance of 7.7 mH, time constant of 150 μ s

Shield

- 16 inches in diameter, 16 inches in length
- 2 mm pure aluminum windows
- Shielding factor > 10,000

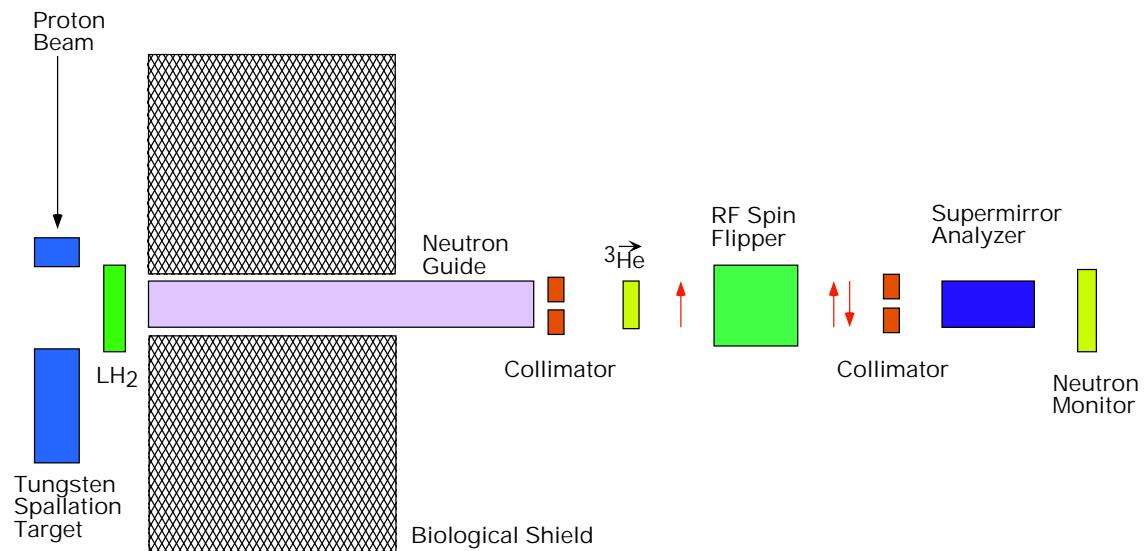
Neutron Guide

- 9.5 cm by 9.5 cm

The Radio Frequency Spin Flipper for the NPDGamma Experiment



Experimental Test of the RF Spin Flipper



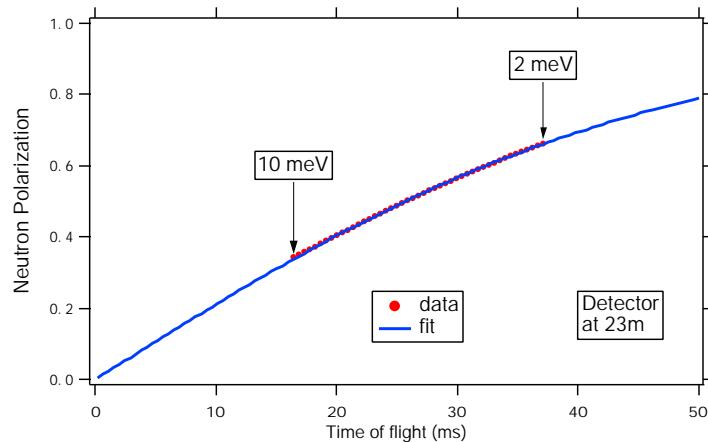
The Polarized ^3He Spin Filter for the NPDGamma Experiment

Polarized ^3He Spin Filter - Test Run Cell

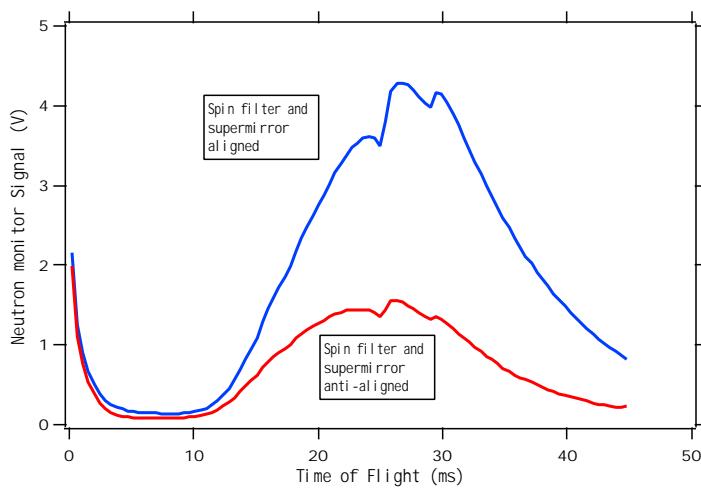


Experimental Test of the RF Spin Flipper

Neutron Beam Polarization

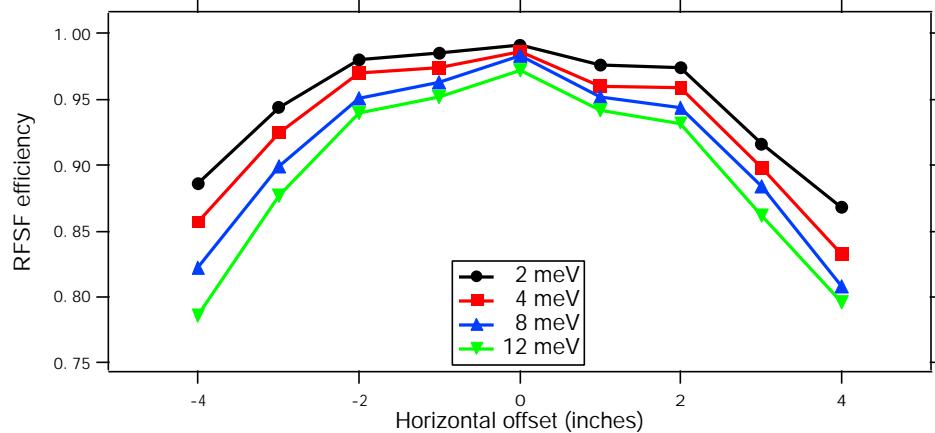


Ion Chamber Signal

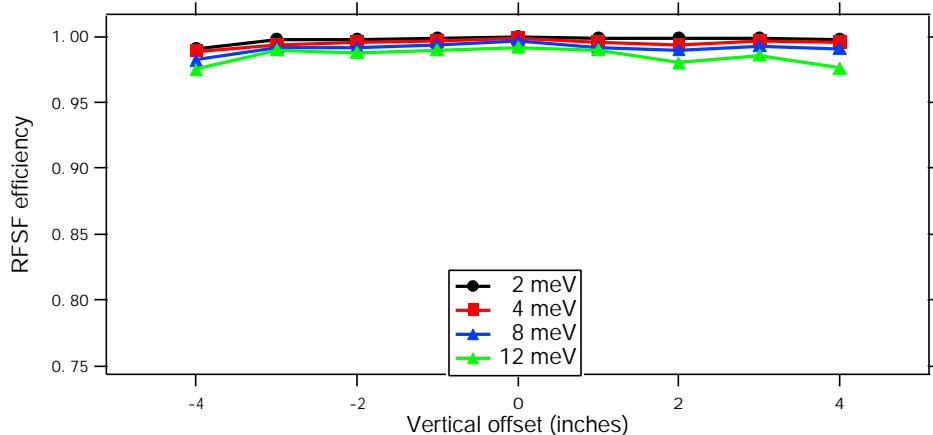


Results for the RF Spin Flipper

Efficiency vs Horizontal Position



Efficiency vs Vertical Position



Conclusion

- The RF Spin Flipper performed with high efficiency
- Some electronics work remains to integrate it into the full NPDGamma Experiment